Web Application Deployment

Robert M. Dondero, Ph.D
Princeton University

Objectives

- The lecture will cover:
  - Web app deployment options

Deployment Options

- **Question**:
  - Where/how might you run Penny app so it's constantly available to the world…
    - Using a production-quality HTTP server?
    - Using a production-quality DBMS?

Deployment Options

- **Answer 1**: Your computer

Deployment Options

- **Answer 2**: Princeton CS Dept HTTP servers
  - See https://csguide.cs.princeton.edu/publishing/webpages
  - Provides MySQL databases
  - Pros and cons:
    - (pro) XXX.cs.princeton.edu domain name
    - (pro) Free
    - (con) Requires CS Dept approval
    - (con) No access to server logs

Deployment Options

- **Answer 3**: Princeton OIT servers
  - Pros and cons:
    - (pro) Free
    - (con) Requires OIT approval
    - (con) Requires sponsorship of some Princeton department
    - (con) Difficult; requires intense cooperation with OIT

Deployment Options

- **Answer 4**: Commercial cloud service
  - Render, Heroku, DigitalOcean, …
  - Pros and cons:
    - (pro) The service does sys admin for you
    - (con) You may need to pay for it!
  - The best option for most COS 333 projects

Deployment Options

- But *which* cloud service?

- Must choose a service for:
  - Web application
  - Database

Deployment Options

A little COS 333 history:

Historical Phase	Application Cloud Service	DB Cloud Service
1	Heroku (free forever)	Heroku (free forever)
SalesForce/Heroku eliminated its free tier		
2	Render (free forever)	Render (free for 3 mths)
2	Render (free forever)	ElephantSQL (free forever)
SalesForce/Heroku teamed with GitHub: GitHub Student Developer Pack		
3	Render (free forever)	Render (free for 3 mths)
3	Render (free forever)	ElephantSQL (free forever)
3	Heroku with GitHub Student Developer Pack (free for 1 yr)	Heroku with GitHub Student Developer Pack (free for 1 yr)

Deployment Options

A little COS 333 history (cont.):

Historical Phase	Application Cloud Service	DB Cloud Service
Render limited its free tier DBs to 1 month ElephantSQL went out of the DB business		
4	Render (free forever)	Render (free for 1 mth)
4	Render (free forever)	Neon (free forever)
4	Heroku with GitHub Student Developer Pack (free for 1 yr)	Heroku with GitHub Student Developer Pack (free for 1 yr)
SalesForce/Heroku extended GitHub Student Developer Pack to 2 yrs		
5	Render (free forever)	Render (free for 1 mth)
5	Render (free forever)	Neon (free forever)
5	Heroku with GitHub Student Developer Pack (free for 2 yrs)	Heroku with GitHub Student Developer Pack (free for 2 yrs)

Deployment Options

A little COS 333 history (cont.):

Historical Phase	Application Cloud Service	DB Cloud Service
SalesForce/Heroku entered a "sustaining engineering" phase		
6	Render (free forever)	Render (free for 1 mth)
6	Render (free forever)	Neon (free forever)
6???	Heroku with GitHub Student Developer Pack (free for 2 yrs)	Heroku with GitHub Student Developer Pack (free for 2 yrs)

Deployment Options

Web app cloud services:

Web App Cloud Service	RAM	Sleeps After 30 Min?	Cost Per Month (Approx)
Render.com Free	0.5 GB	yes	$0 *
Render.com Starter	0.5 GB	no	$7
Heroku Eco	0.5 GB	no	$5 **
Heroku Basic	0.5 GB	no	$7 **

* Slow deployment

** *GitHub Student Developer Pack* provides $13/month for 2 years; cannot renew

Deployment Options

Database cloud services (cont.):

DB Cloud Service	Time Period	Size	Concurrent Connections	Cost Per Month (Approx)
Render.com Free	1 month *	.25 GB	100	$0
Render.com Basic-256mb	Unlimited	.25 GB	100	$6
Neon Free Plan	Unlimited	.5 GB	10000	$0
Neon Launch	Unlimited	10 GB	10000	$5 + usage
Heroku Essential 1	Unlimited	1 GB	20	$5 **
Heroku Essential 2	Unlimited	10 GB	20	$9 **

* Can create another

** *GitHub Student Developer Pack* provides $13/month for 2 years; cannot renew

Deployment Options

- All of those DB options (can) use ***PostgreSQL***

Deployment Options

Michael Stonebreaker

Deployment Options

- PostgreSQL assessment (vs. SQLite)
  - (con) Setup on local computer (not shown) is **much** more complex
  - (con) Setup on cloud service is more complex
  - (pro) Production-quality
    - Distinct process
    - Authentication
    - Row-level (vs. database-level) locking
    - Read/write (not read-only) for apps deployed to the cloud
    - …

Summary

- We have covered
  - Web app deployment options
- See also:
  - **Appendix 1**: Cloud Service Types
  - **Appendix 2**: Render vs. Heroku

Appendix 1:
Cloud Service Types

Cloud Service Types

- ***Software as a Service (SaaS)***
  - "The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure."
    -- https://en.wikipedia.org/wiki/Cloud_computing
  - Examples: Google Docs, Microsoft Word Online

Cloud Service Types

- ***Platform as a Service (PaaS)***
  - "The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider."
    -- https://en.wikipedia.org/wiki/Cloud_computing
  - Examples: Render, Heroku, Google App Engine

Cloud Service Types

- ***Infrastructure as a Service (IaaS)***
  - "The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications."
    -- https://en.wikipedia.org/wiki/Cloud_computing
  - Examples: Amazon Web Services (AWS), Google Cloud Platform, Microsoft Azure

Cloud Service Types

- Which **cloud service type** for Penny?
  - SaaS: impossible; too narrow
  - IaaS: possible, but too broad
  - **PaaS**: just right!

Appendix 2:
Render vs. Heroku

Render vs. Heroku

- Render
  - (pro) Easier to create DB
  - (pro) Can create DB and app in either order
  - (pro) Easier to create app
  - (pro) Stable DB URL
  - (pro) Free
- Heroku
  - (pro) Faster deploys
  - (pro) Faster cold app launch
  - (pro) Faster app???
  - (pro) DB does not expire

Render vs. Heroku

- Render
  - (con) Slower deploys
  - (con) Slower cold app launches
  - (con) Slower app???
  - (con) DB expires after 1 month
    - But can move data to new DB
- Heroku
  - (con) Harder to create app
  - (con) Must create app before DB
  - (con) Harder to create DB
  - (con) Unstable DB URL
  - (con) Costs money
    - But non-renewable *GitHub Student Developer Pack* covers 2 years